

The Center for Nanoscale Materials At Argonne National Laboratory

Scientific Achievement

Staff scientists from the Materials Science Division have been instrumental in creating a new Division at Argonne, the Center for Nanoscale Materials (CNM), including helping to define its scientific themes and working to establish its technical infrastructure. The CNM is a Department of Energy Nanoscale Science Research Center and User Facility for the fabrication and exploration of advanced nanomaterials. It will enable all stages of research and development on nanoscale materials, from synthesis and patterning through metrology, chemical and structural determination, properties characterization, and theory. The Center's location at Argonne takes advantage of the hard x-ray Advanced Photon Source (APS), the Intense Pulsed Neutron Source, and the Electron Microscopy Center. The Office of Basic Energy Sciences will fund the Center's equipment and operations. The CNM will be located adjacent to the APS in a building funded by the State of Illinois. The CNM is constructing a hard x-ray nanoprobe beamline at the APS to focus down to an unprecedented resolution of 30 nanometers.

Significance

Creation of the CNM will provide the Materials Science Division, Argonne, and the nation with a state-of-the-art user facility for the development and dissemination of the science and techniques required for the design, synthesis, characterization and theory of materials at the nanoscale. The CNM will bridge materials, chemical, biological and computational sciences and advanced characterization tools. The facilities and expertise resident in the CNM (for instance, for oxide molecular beam epitaxy) will allow MSD to more effectively exploit its strengths in the field of nanoscience. CNM's hard x-ray nanoprobe will be ideally suited to high spatial resolution exploration of nanomaterials under controlled environmental conditions, enabling MSD scientists to perform in situ studies of many systems that are central to MSD's core research programs, using techniques that are highly complimentary to MSD's thrusts in electron beam nanocharacterization.

Performers

MSD Contributors to the CNM: S. Bader, S.K. Streiffer, G.B. Stephenson, J.A. Eastman, W. Kwok, G. Crabtree, M. Firestone, O. Auciello, J. Carlisle, D. Gruen, J. Pearson, D. Fong, A. Bhattacharya, A. Hoffmann, P. Zapol (ANL-MSD)

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Facilities and Expertise for Partnership

- 85,000 sq. ft. building to be completed April 2006
- Scientific and user programs to be fully running by Fall 2007

13,000 sq. ft. conventional labs, 11,000 sq. ft. cleanrooms



CNM Equipment

- Nanosynthesis
 - Self-assembly
 - Bio/organic/inorganic synthesis
 - Thin film synthesis
- Nanopatterning
 - High-voltage electron beam lithography
 - Focused ion beam patterning
 - Nanoimprint lithography
- Characterization
 - Scanning probes
 - Confocal fluorescence optical microscopy
 - Ultrafast pump-probe near-field scanning optical microscopy
 - Hard x-ray nanoprobe
- Theory and Simulation
 - Leveraging ANL leadership computing

CNM User Program

- Open access for all users, via peer-reviewed proposals

CNM Scientific Groups

- BioNano Composites
- Electronic and Magnetic Materials and Devices
- Nanophotonics
- Theory and Simulation
- Nanopatterning
- X-Ray Imaging & Scattering

The Hard X-Ray Nanoprobe

